Project Introduction

To demonstrate a massively parallel optical ray trace to enable the design and analysis of extremely large aperture optical systems. This, in turn, enables model-based V&V and quantification of margins and uncertainties (QMU) which cannot be performed using existing software packages.

Develop and demonstrate a software architecture, initially based on GPU's but expandable to multiple CPU platforms, to provide optical raytraces with more than 232 independent rays (current capability is 224). The new software architecture will use GPU programming techniques developed for the Palomar P3K adaptive optics system (world-record holder for number of actuators and speed). Systems like TMT, CCAT, ATLAST will require this large number of rays to accurately model and verify their system performance A demonstration connecting existing single-threaded tools (MACOS) to SIERRA has been done by Lee Peterson and Scott Basinger and proven to be a powerful new tool for truly integrated modeling.

Anticipated Benefits

There is no comparable capability for integrated modeling like SIERRA in any existing software packages, due in large part to the massive investment on the part of the DOE in developing SIERRA. Since there is no optical capability, adding optics to this already unique and powerful package will truly be state-of-the-art and give JPL an edge in optical and integrated modeling capabilities and model-based V&V.

Impacted projects will be large-aperture optical, infrared, and sub-millimeter systems in both astrophysics (e.g. TMT, CCAT, OPTIIX, ATLAST, WFIRST) and Earth science (e.g. hyperspectral imaging systems, seismic monitors).

Once a successful demonstration has been made, further funding will be sought from projects who will utilize the modeling tools that we develop from this proposal. The 740 program will be a likely customer to continue to fund this effort once its feasibility is proven. It has already expressed interest in real-time optical modeling for V&V.

Optics for SIERRA

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)
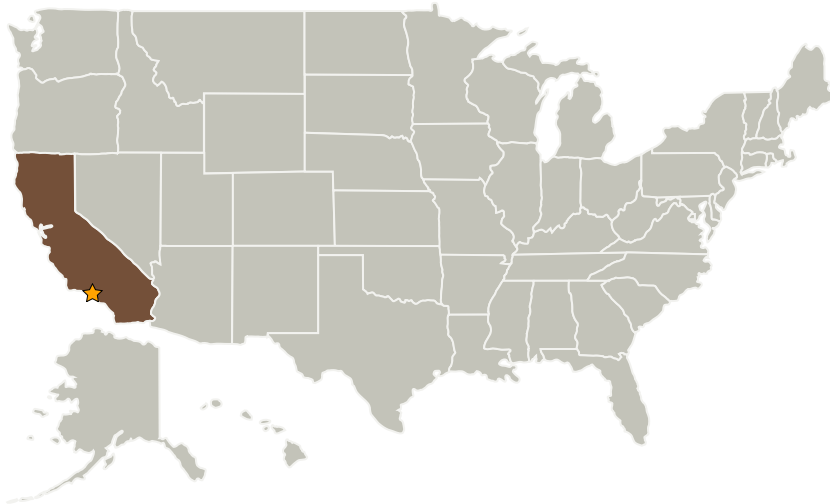
Responsible Program:

Center Innovation Fund: JPL CIF

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
⭐Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Project Management

Program Director:
Michael R Lapointe

Program Manager:
Fred Y Hadaegh

Project Manager:
Jonas Zmuidzinas
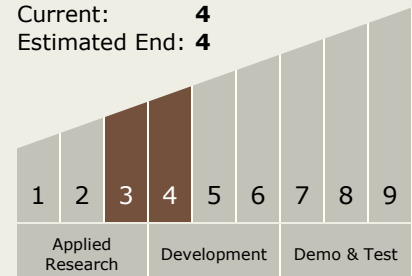
Principal Investigator:
Scott A Basinger

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**

1	2	3	4	5	6	7	8	9
Applied Research			Development			Demo & Test		

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  └ TX11.4 Information Processing
    └ TX11.4.4 Collaborative Science and Engineering

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